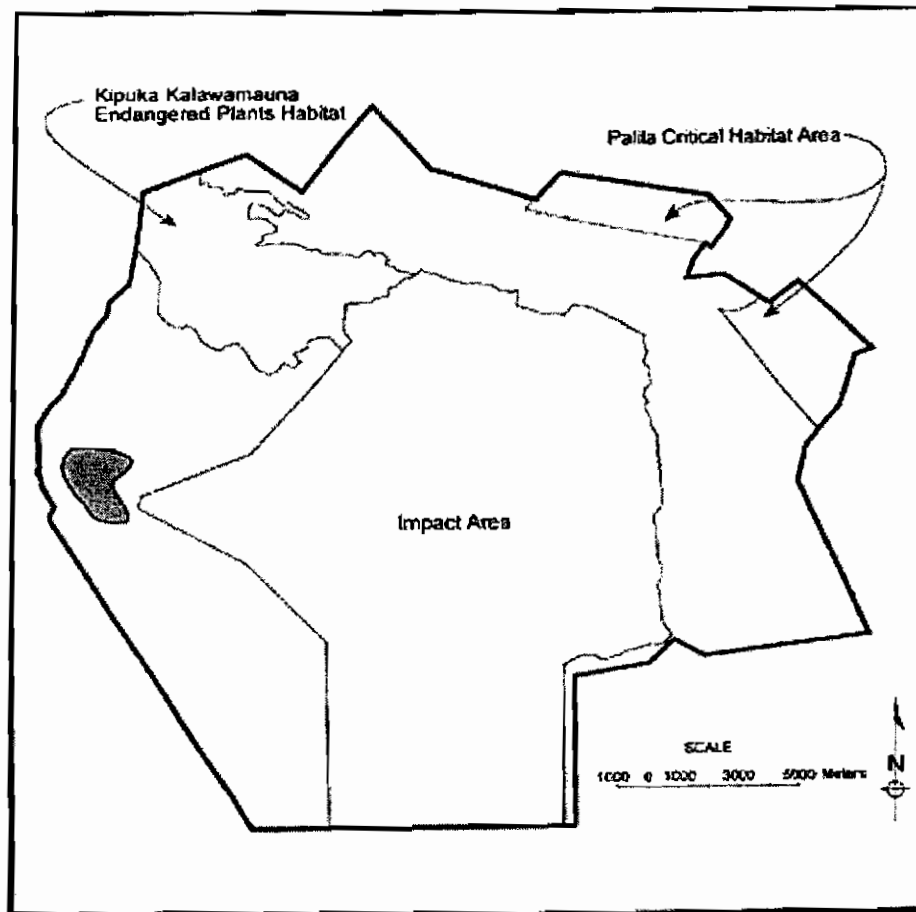
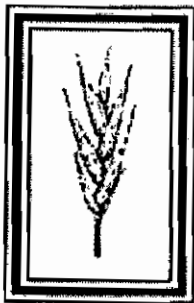




**Figure 22.** Distribution of *Exocarpus gaudichaudii* on Pohakuloa Training Area, Hawaii.



***Festuca hawaiiensis* Hitchc.**



**Family:** Poaceae (Gramineae, Grass Family)

**Common Name:** Hawaiian Fescue

**Federal Status:** Species of Concern

**Description:**

**Life Span:** perennial. **Habit:** erect and tufted grass up to 1.5 m tall. **Vegetative:** leaves mostly basal, long and linear, usually flat and hairless; ligule a short membrane. **Floral:** inflorescence an open, drooping panicle; spikelets with 3-7 flowers. **Fruit:** a caryopsis.

**Distribution:**

**Historical:** Maui and Hawaii. **Current:** Known only from the southwest portion of PTA in Kipuka Alala and surrounding areas.

**Habitat:**

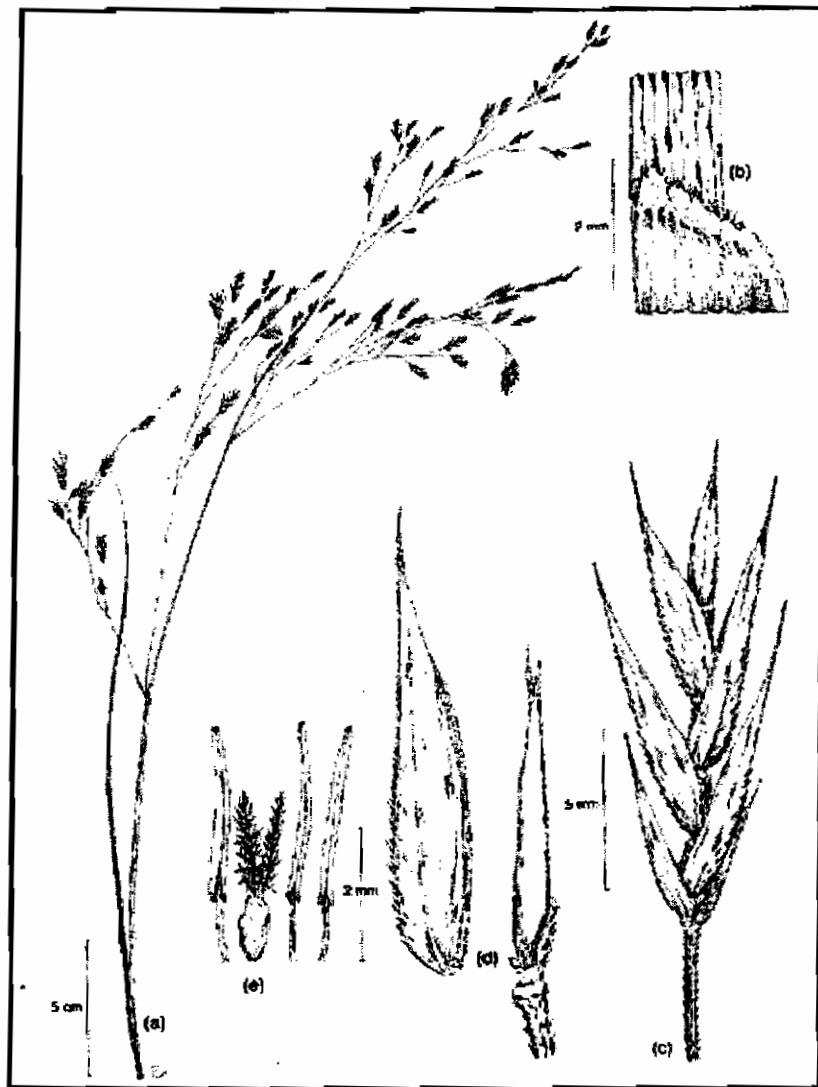
**Substrate:** *Festuca hawaiiensis* grows on Mauna Loa aa and pahoehoe flows 2,000-5,000 years old. **Plant Communities:** Sparse *Metrosideros* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Intermediate *Metrosideros* Mixed Treeland, *Myoporum* Shrubland, *Myoporum-Sophora* Mixed Shrubland, *Myoporum-Sophora* Shrubland with forb understory, and *Styphelia* Mixed Shrubland.

**Estimated Number of Individuals on PTA:** > 1,000

**Threats:** Invasions of habitat by alien species, particularly fountain grass (*Pennisetum setaceum*), presents the greatest threat to *F. hawaiiensis*. This grass does not appear to be palatable to feral sheep, goats, or hogs, and is not susceptible to fire.

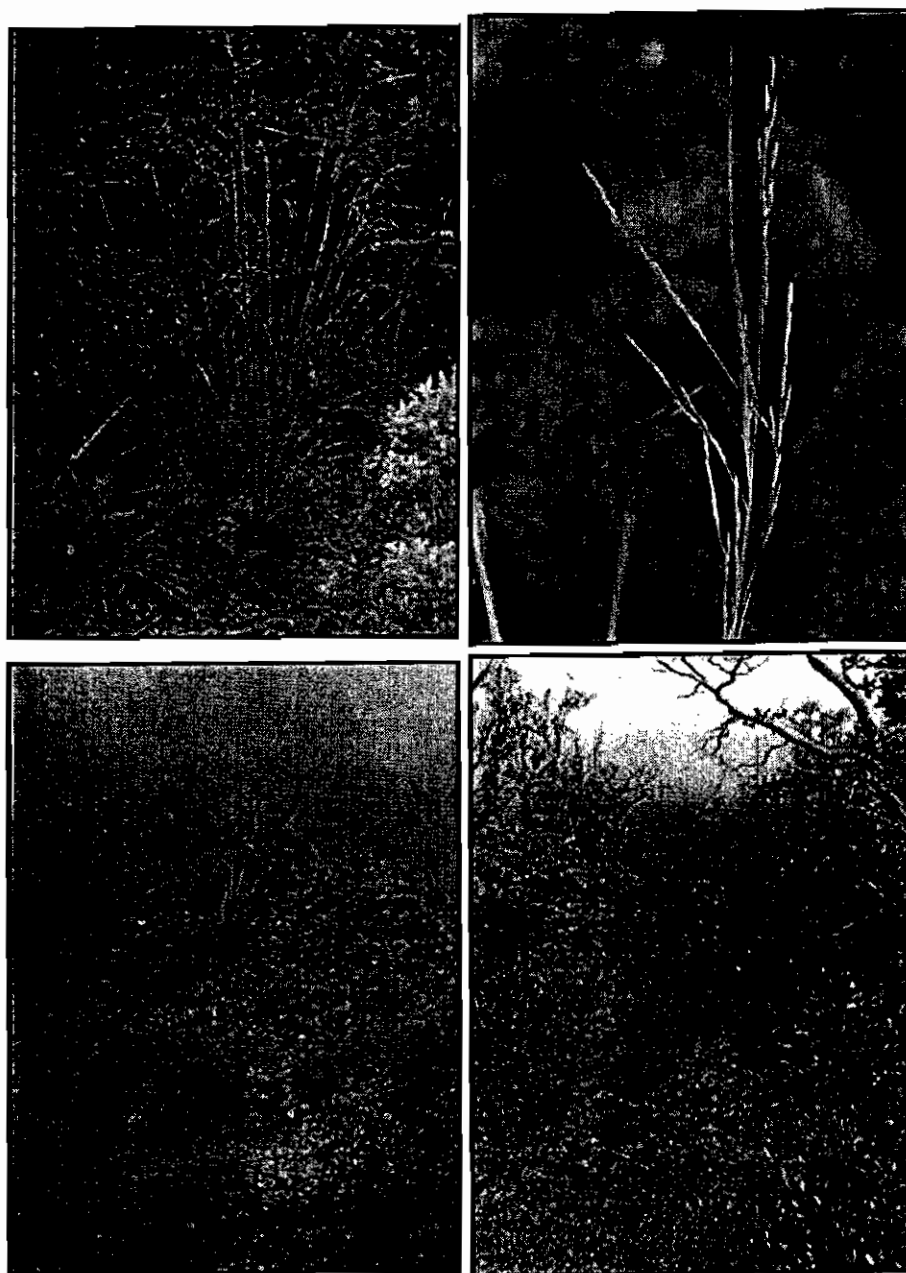
**Comments:** Further study is needed to determine the taxonomic validity of *F. hawaiiensis*. If it is native to the islands, then the grass must have colonized fairly recently (in evolutionary terms) because it has not diversified. Also, if *F. hawaiiensis* is found to be a valid species, then it warrants protection under the Endangered Species Act.

**Figure 23.** *Festuca hawaiiensis*: (a) mature panicle inflorescence; (b) ligule composed of a ciliate membrane; (c) spikelet with five florets; (d) floret with lemma separated to expose the palea; and (e) three stamens and ovary with two plumose style branches.

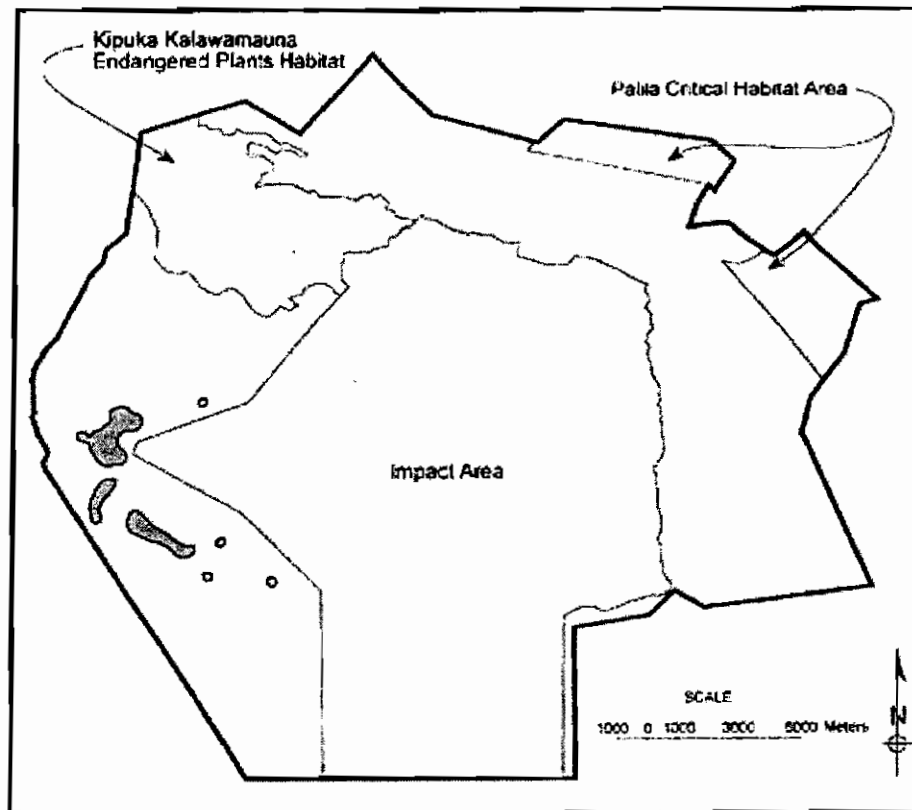


**Figure 24.** *Festuca hawaiiensis*: (a) mature individual growing in *Myoporum* Shrubland; (b) inflorescence soon after exertion from subtending leaf sheath; (c) typical habitat in Intermediate *Metrosideros* Mixed Treeland; and (d) species growing with *Silene hawaiiensis* on young aa lava. Below clockwise from upper left:





**Figure 25.** Distribution of *Festuca hawaiiensis* on Pohakuloa Training Area, Hawaii.



***Haplostachys haplostachya* (A. Gray) St. John**



**Family:** Lamiaceae (Labiatae, Mint Family)

**Common Name:** Hawaiian Mint, Honohono

**Federal Status:** Endangered

**Description:**

**Life Span:** perennial. **Habit:** erect subshrub (slightly woody at base) up to 1.5 m tall. **Vegetative:** stems square; leaves opposite, lance-shaped; top of leaf green, underside of leaf light green to white; foliage covered with dense, tangled or matted woolly hairs. **Floral:** flowers arranged spirally around the stem; large, white, irregularly shaped, and fragrant. **Fruit:** four black, hard nutlets per flower.

**Distribution:**

**Historical:** Kauai, Maui, and Hawaii. **Current:** Only known to exist on PTA lands managed by the U.S. Army. Some of this area is private property leased to the Army. The plant has been found at Puu Ka Pele, Puu Leilani, 200 m west of Puu Ahi, south of Puu Keekee, and scattered throughout most of the eastern half of Kipuka Kalawamauna Endangered Plants Habitat.

**Habitat:**

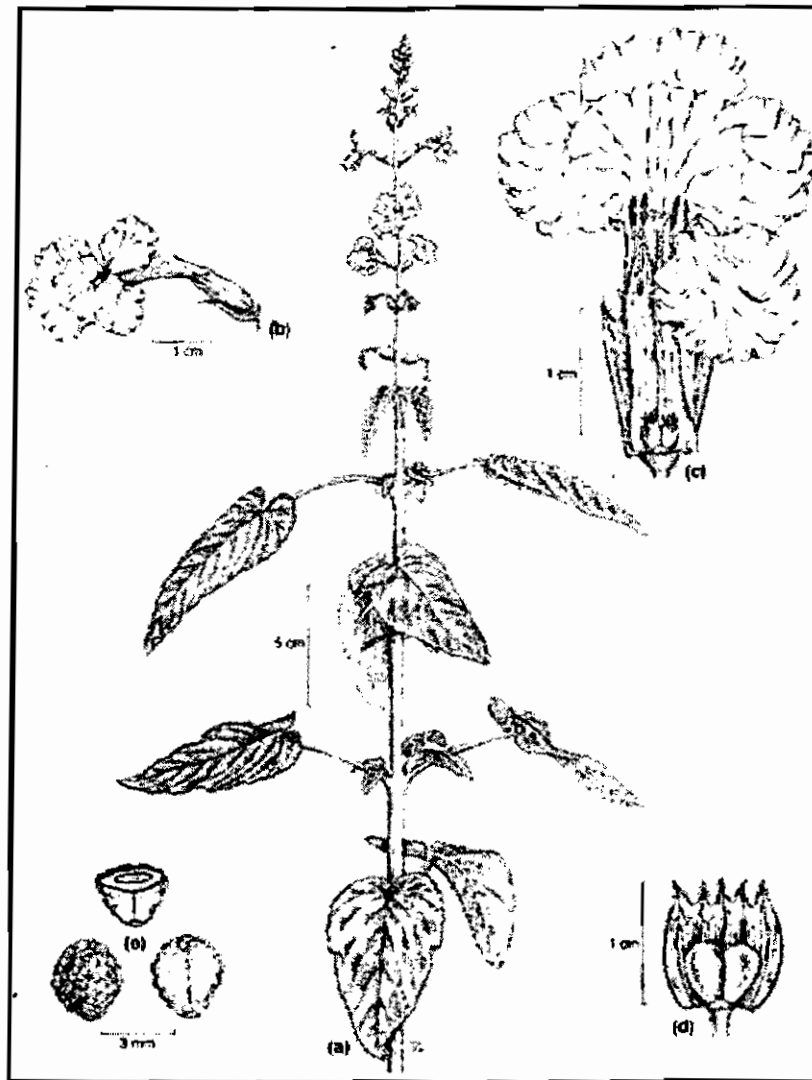
**Substrate:** *Haplostachys haplostachya* occurs almost exclusively on very old Mauna Kea flows (> 10,000 years old flow). A small population inhabits Mauna Loa pahoe-hoe lava (approximately 900 years old). **Plant Communities:** *Chamaesyce* Treeland, Open *Metrosideros* Treeland with dense shrub understory, Open *Dodonaea* Shrubland, *Dodonaea* Mixed Shrubland, *Myoporum* Shrubland, and *Myoporum-Dodonaea* Shrubland.

**Estimated Number of Individuals on PTA:** > 20,000

**Threats:** Feral sheep and goats have been observed browsing floral parts and seeds on occasion; however, the foliage does not appear to be palatable. Some browsing on the foliage was documented when plants resprouted after the July 1994 Kipuka Kalawamauna fire. Fountain grass (*Pennisetum setaceum*) is rapidly invading many *H. haplostachya* populations and competing for resources. The major threat is wildfire, but individuals can survive burning if the fire is of low to moderate intensity.

**Comments:** *Haplostachys haplostachya* represents the only remaining member of the genus; thus, it is probably the most important rare species on PTA.

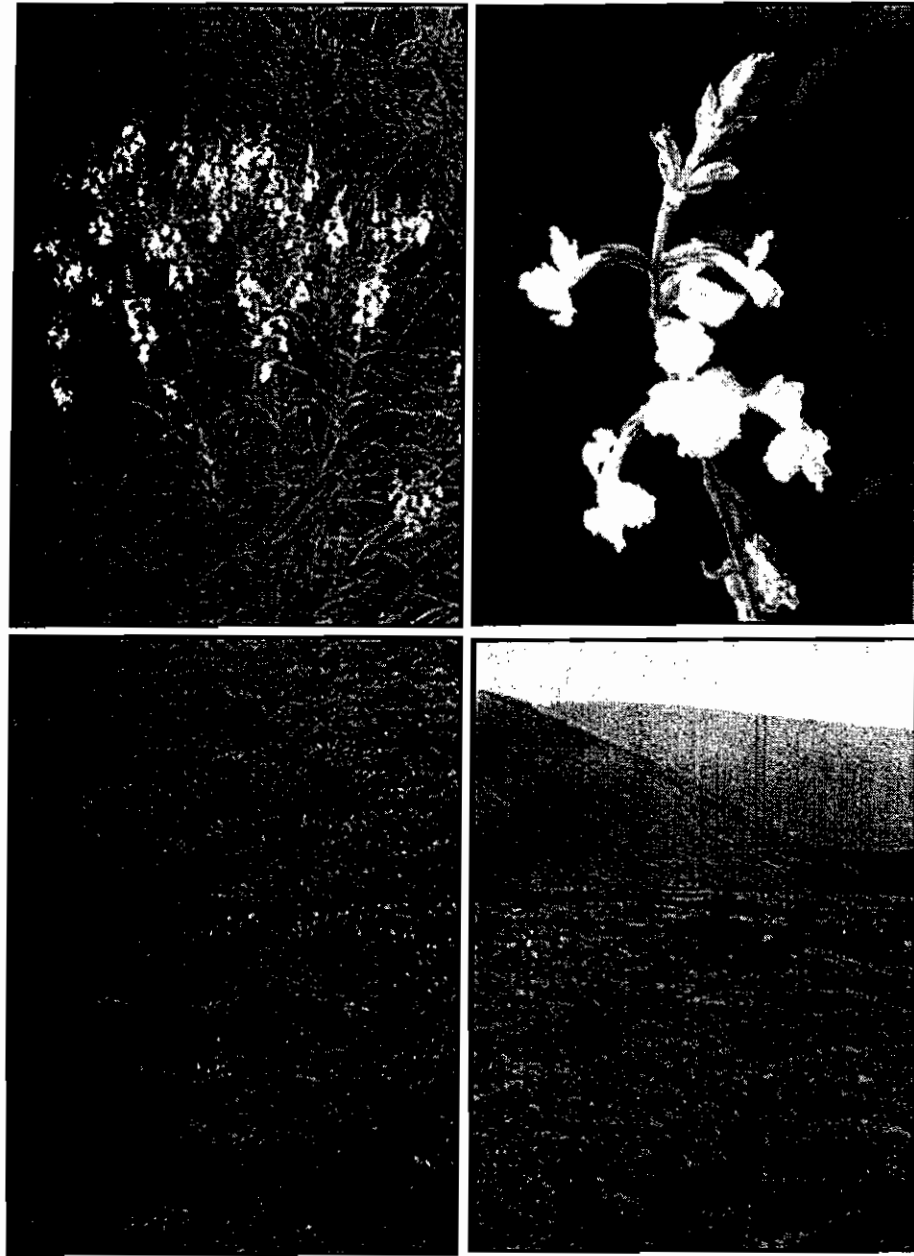
**Figure 26.** *Haplostachys haplostachya*: (a) upper stem showing opposite, simple leaves and terminal raceme inflorescence; (b) a single, bilabiate, funnelform flower; (c) corolla tube opened to expose four stamens adnate to the corolla wall and two-lobed style; (d) corolla removed to show the superior ovary with four distinct segments; and (e) several views of nutlet.



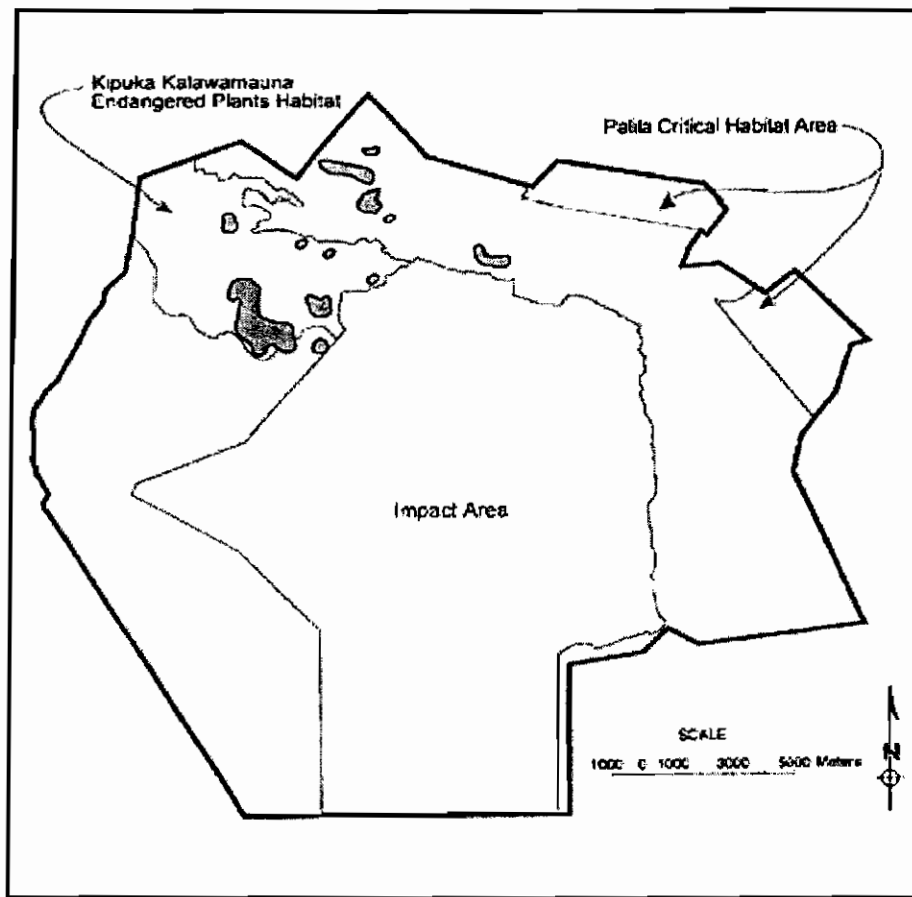
**Figure 27.** *Haplostachys haplostachya*: (a) general habit of moderate-sized individual with numerous flowering stems; (b) close-up of inflorescence and bilabiate flower; (c) southern flank of Puu Ka Pele which supports the single largest population of the species; and (d) dense stand of *H. haplostachya* on Puu Ka Pele.

*Below clockwise from upper left:*





**Figure 28.** Distribution of *Haplostachys haplostachya* on Pohakuloa Training Area, Hawaii.



*Hedyotis coriacea* Sm



**Family:** Rubiaceae (Coffee Family)

**Common Name:** Leather-leaf Sweet Ear, Kioele

**Federal Status:** Endangered

**Description:**

**Life Span:** perennial. **Habit:** small, erect shrub; the plant may develop a more woody habit if protected from grazing for extended periods. **Vegetative:** stems round; stipules up to 3 mm long; leaves opposite, lance-shaped to elliptical, margins entire; leaf tip typically purple. **Floral:** flowers in a small and simple inflorescence; petals white or cream colored, fleshy. **Fruit:** a capsule with thick walls and numerous small, dark brown, irregularly angled seeds.

**Distribution:**

**Historical:** Oahu, Maui, and Hawaii. **Current:** Known only from a single plant on Maui and some plants on the west side of PTA in the Kipuka Kalawamauna Endangered Plants Habitat, along Charlie Circle, and near Kipuka Alala.

**Habitat:**

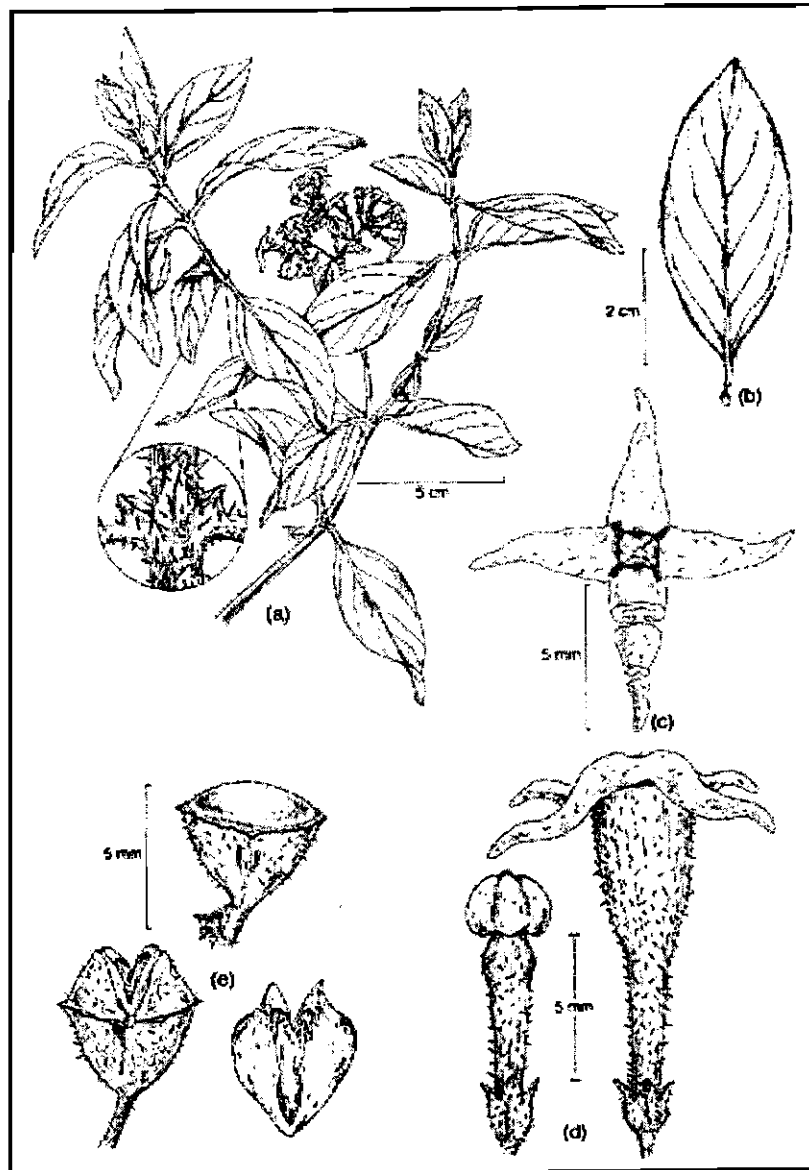
**Substrate:** *Hedyotis coriacea* is extremely rare on Mauna Loa pahoehoe lava flows 900-2,000 years old. **Plant Communities:** Sparse *Metrosideros* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, and Open *Metrosideros* Treeland with dense shrub understory.

**Estimated Number of Individuals on PTA:** Over 40 individuals have been found on the installation; it is possible that more plants will be found with more extensive surveying.

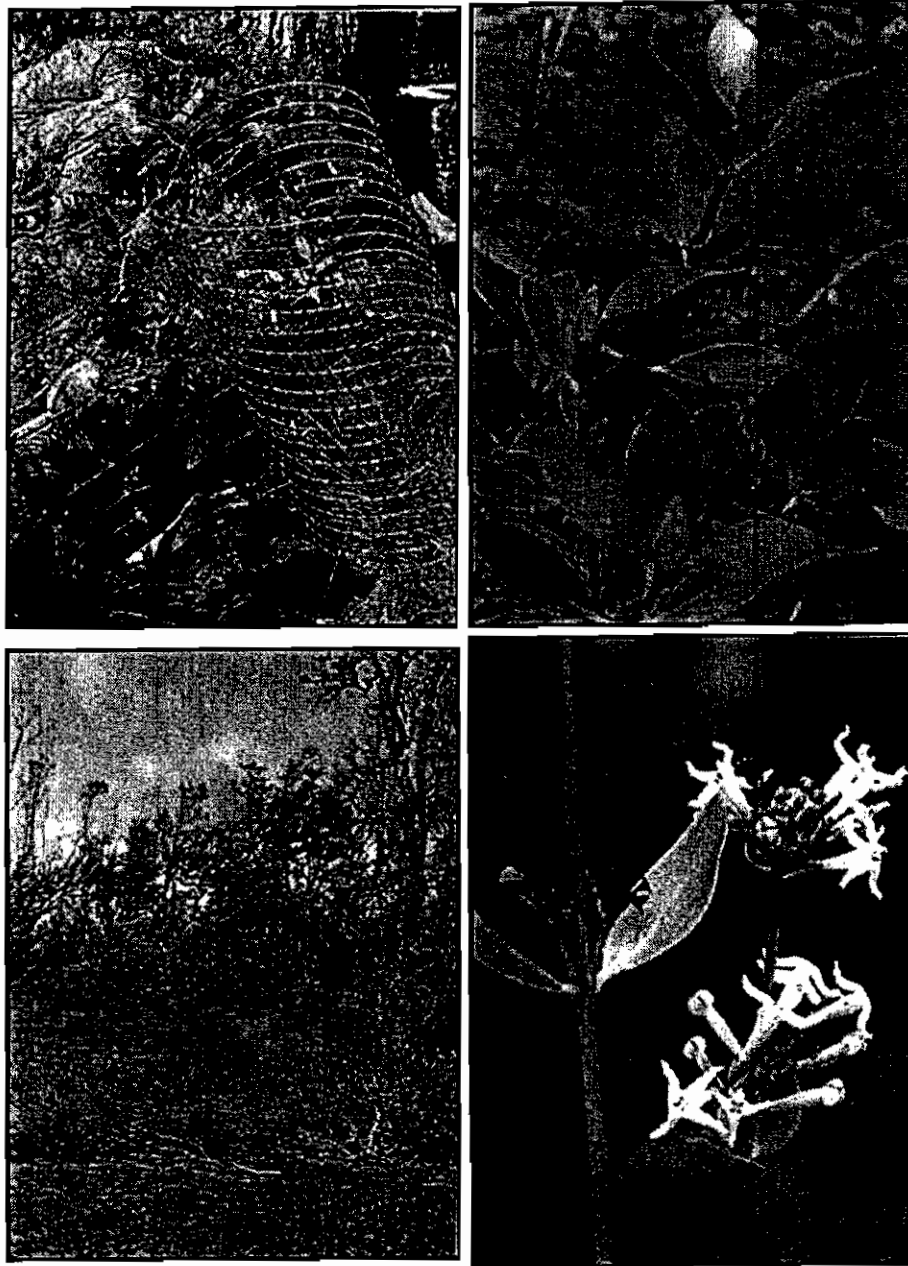
**Threats:** The small number of individuals of *Hedyotis coriacea* make the species very susceptible to extinction. Also, the species apparently is very palatable to feral sheep and goats because many plants found on the installation have been browsed heavily.

**Comments:** Based on number of individuals, *Hedyotis coriacea* is one of the rarest species on the installation. A wire cage should be placed around every known *H. coriacea* individual to protect it from browsing by feral animals, allowing the plants to reproduce. Very little is known about the reproductive potential of this species due to its extreme rarity.

**Figure 29. *Hedyotis coriacea*:** (a) upper branch showing opposite leaf arrangement and cymose inflorescence (insert shows node with small stipules); (b) simple leaf with entire margins; (c) top view of expanded corolla lobes; (d) side view of flower prior to and after corolla expansion; and (e) cup-shaped capsule, capsule splitting across disc, and irregularly angled seed.

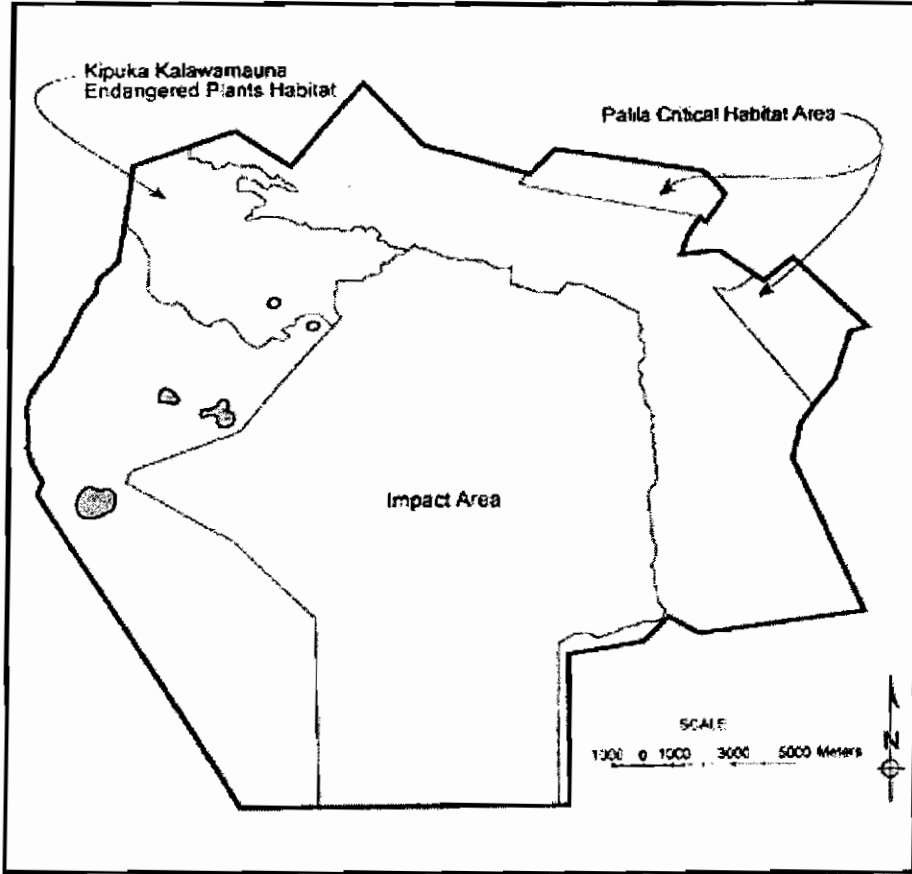


**Figure 30.** *Hedyotis coriacea*: (a) small specimen enclosed by wire cage to protect the plant from being browsed by feral sheep and/or goats; (b) plant growing in crack on pahoe-hoe lava (note shiny coriaceous leaves); (c) cream-colored flowers in cymose inflorescence; and (d) typical habitat in Open *Metrosideros* Treeland with sparse shrub understory. Below clockwise from upper left:

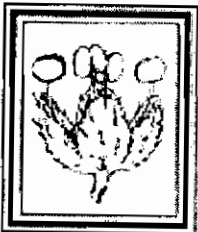


**Figure 31.** Distribution of *Hedyotis coriacea* on Pohakuloa Training Area, Hawaii.





*Hesperocnide sandwicensis* (Wedd.) Wedd.



**Family:** Urticaceae (Nettle Family)

**Common Name:** Hawaiian Stinging Nettle

**Federal Status:** None (previously proposed as Endangered)

**Description:**

**Life Span:** annual. **Habit:** erect, occasionally branched forb up to 5 dm tall. **Vegetative:** stems and leaves covered with numerous stinging hairs; leaves simple, opposite, lance-shaped with serrate margins. **Floral:** unisexual (but plants with both sexes on same plant). **Fruit:** an achene enclosed by calyx which has 2-4 distinct hooked spines.

**Distribution:**

**Historical:** Known only from the slopes of Mauna Kea, Mauna Loa, Hualalai, and the saddle region of Hawaii. **Current:** Same as historical distribution.

**Habitat:**

**Substrate:** *Hesperocnide sandwicensis* grows on aa and pahoehoe lavas of all ages. **Plant**

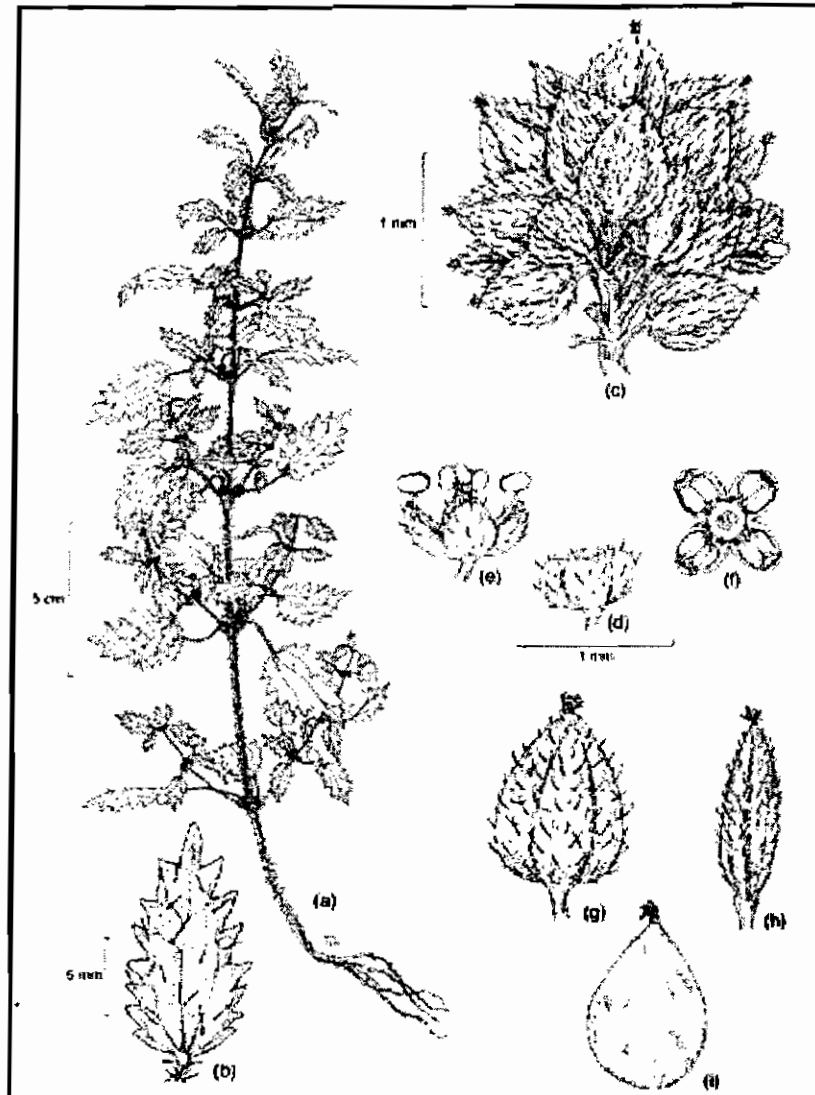
**Communities:** The species has been found in all 24 plant communities, and it should be expected in moist environments anywhere on the installation.

**Estimated Number of Individuals on PTA:** Because the species is an annual, it is difficult to ascertain the number of individuals. However, based on estimates(extrapolated by multiplying the average density of the species in its preferred habitat times the total habitat area), more than a million individuals is possible.

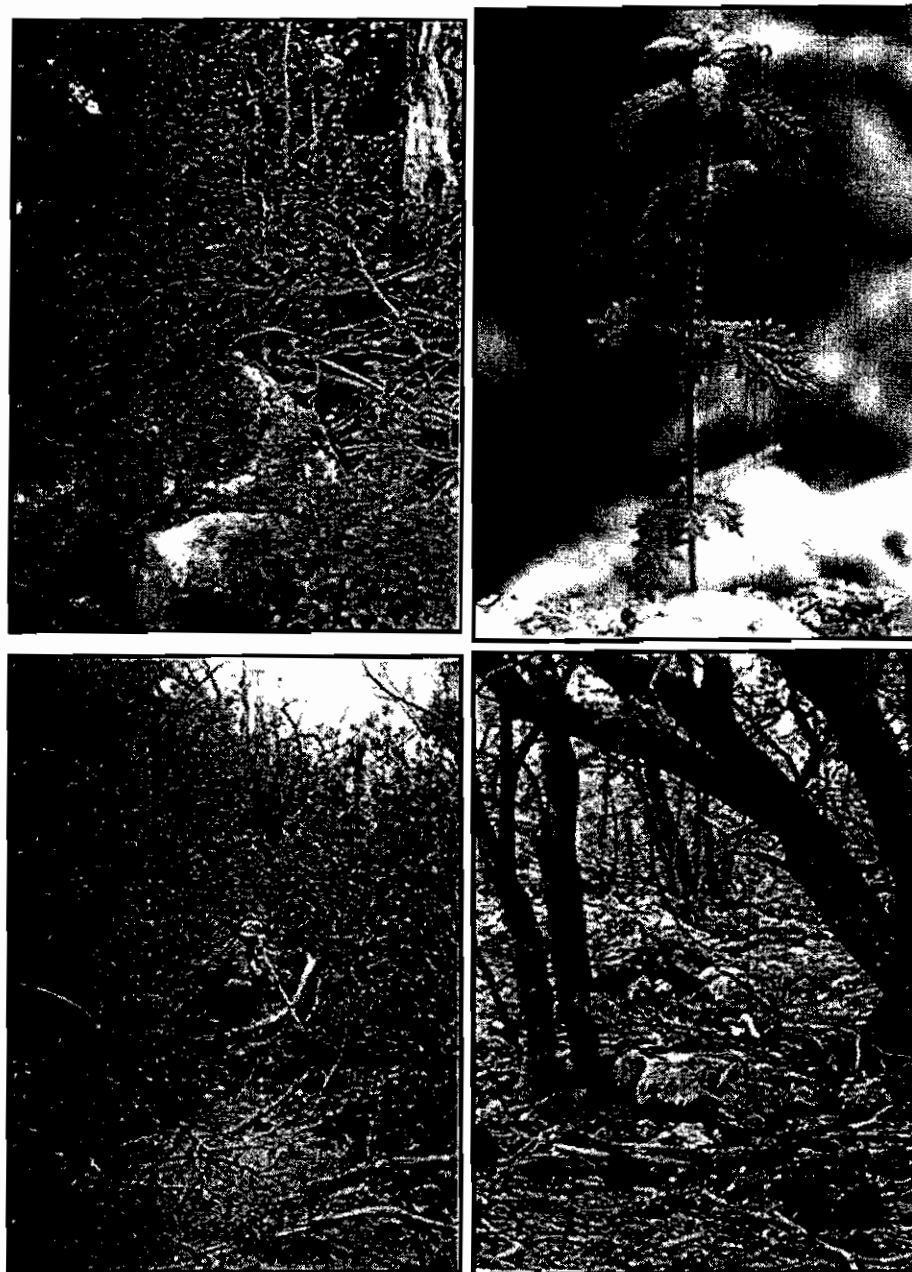
**Threats:** Feral ungulates browse the species, despite the numerous stinging hairs. Any time a *Myoporum*-dominated plant community is disturbed by military activities, there is potential for to this taxon to be impacted.

**Comments:** *Hesperocnide sandwicensis* frequently grows with, and can be confused with, *Urtica urens* (dog nettle). *Hesperocnide sandwicensis* has fused calyx lobes, while *U. urens* has distinctly separate calyx lobes. Both species have equally obnoxious stinging hairs, which cause a burning irritation when contacted; however, areas affected by *H. sandwicensis* become numb soon after contact.

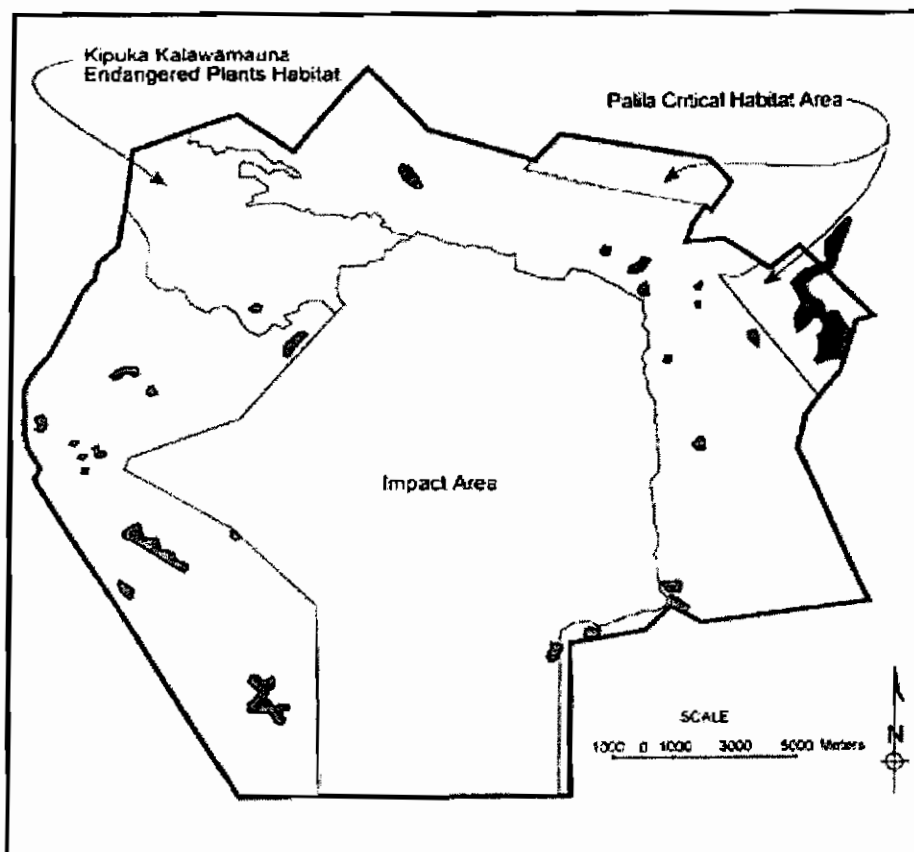
**Figure 32.** *Hesperocnide sandwicensis*: (a) general habit; (b) simple leaf with stinging hairs; (c) cluster of mostly pistillate flowers which occur in leaf axils; (d) closed staminate flower; (e) side-view of open staminate flower; (f) top view of staminate flower; (g) pistillate flower with hooked hairs on calyx; (h) side-view of pistillate flower; and (i) achene.



**Figure 33.** *Hesperocnide sandwicensis*: (a) large individual growing along margin of aa lava flow; (b) close-up of single stem showing opposite leaf arrangement and stinging hairs; (c) *Myoporum-Sophora* Shrubland with forb understory where species commonly occurs; and (d) typical habitat for species in *Myoporum* Mixed Shrubland community.  
Below clockwise from upper left:



**Figure 34.** Distribution of *Hesperocnide sandwicensis* on Pohakuloa Training Area, Hawaii.



***Melicope hawaiiensis* (Wawra) T. Hartley & B. Stone**



**Family:** Rutaceae (Citrus Family)

**Common Name:** Mokihana kukae moa, manena

**Federal Status:** Species of Concern

**Description:**

**Life Span:** perennial. **Habit:** shrub or tree up to 10 m tall. **Vegetative:** bark light brown, mottled, smooth; leaves simple, opposite, leathery, elliptical in shape, margins entire.

**Floral:** flowers unisexual or occasionally perfect in axillary cymes. **Fruit:** Four distinct follicles, usually with 2 seeds in each.

**Distribution:**

**Historical:** Hawaii, Lanai, Maui, Molokai. **Current:** Still a fairly widespread species in dry to mesic forests. Very rare on the west side of PTA.

**Habitat:**

**Substrate:** *Melicope hawaiiensis* has been found on a Mauna Loa pahoe flow



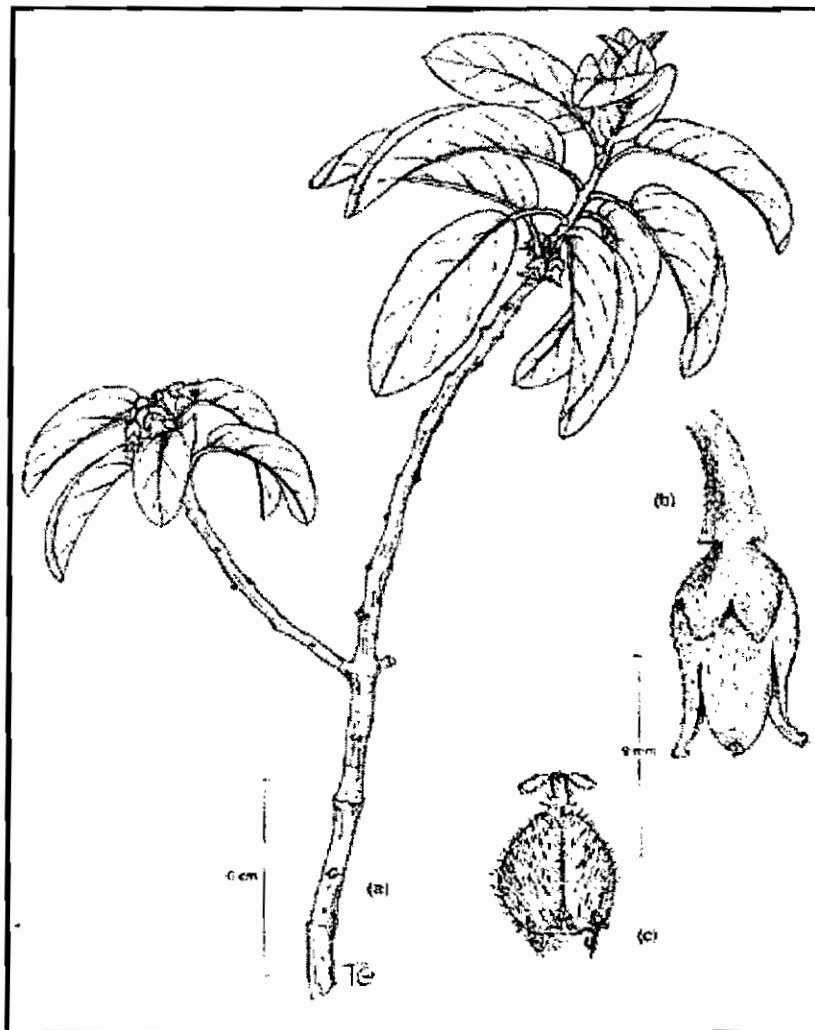
estimated to be 4,000 years old. **Plant Communities:** Intermediate *Metrosideros* Mixed Treeland, *Dodonaea* Mixed Shrubland

**Estimated Number of Individuals on PTA:** Three individuals are known to occur on PTA; however, further surveys for this species would undoubtedly reveal more plants.

**Threats:** Wildfire would impact the species negatively, but the probability of large fires in the treelands on PTA is relatively low. Damage by sheep and/or goats has not been observed. Plants grow in deep lava cracks which may have provided the seedlings and saplings with some protection from browsing during establishment.

**Comments:** *Melicope* is a large genus in which species are difficult to differentiate; identification without flowers and fruits is tenuous at best. *Melicope hawaiiensis* is one of the more abundant members of the genus, but recent reductions in numbers and distribution warrant monitoring the species.

**Figure 35.** *Melicope hawaiiensis*: (a) general habit; (b) flower showing densely pubescent pedicel, and fused sepals and petals; and (c) immature ovary (note reduced stamens).

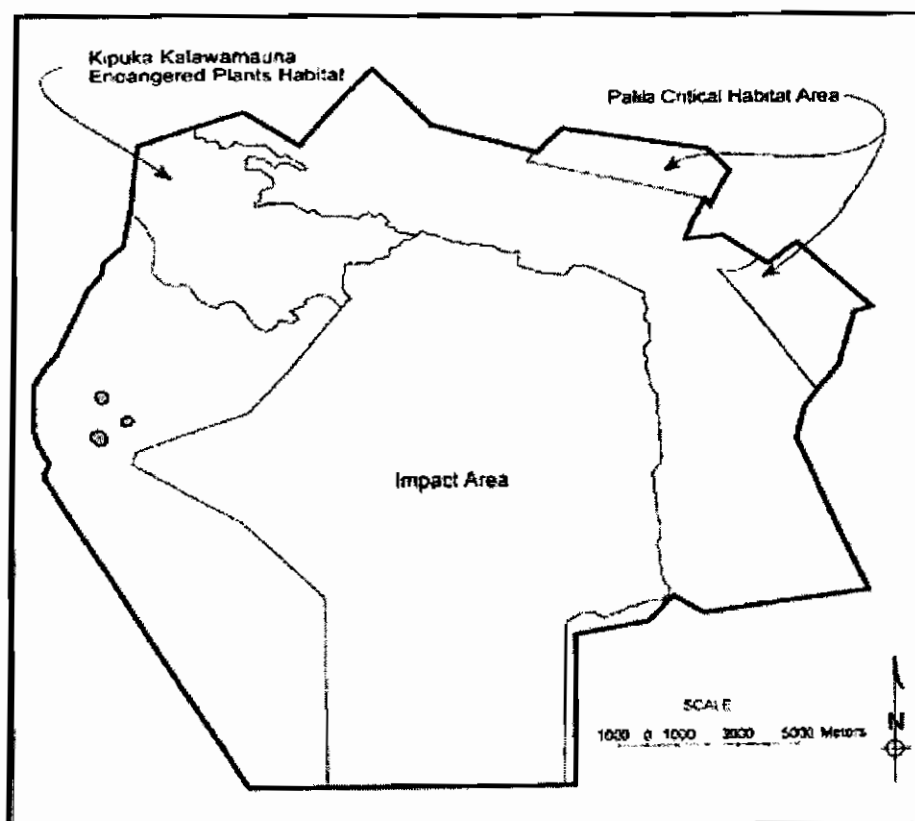


**Figure 36.** *Melicope hawaiiensis*: (a) general habit; (b) close-up showing leaves clustered at branch tip; (c) flowers in axis of leaves; and (d) *Dodonaea* Mixed Shrubland where species is found.

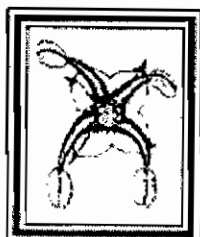
*Below clockwise from upper left:*



**Figure 37.** Distribution of *Melicope hawaiiensis* on Pohakuloa Training Area, Hawaii.



***Neraudia ovata* Gaud.**



**Family:** Urticaceae (Nettle Family)

**Common Name:** Spotted Nettle Bush

**Federal Status:** Endangered

**Description:**

**Life Span:** perennial. **Habit:** shrub or small tree up to 5 m tall. **Vegetative:** stem up to about 20 cm in diameter, covered with lenticels; leaves alternate, simple, distinctly veined with three prominent nerves, covered with light-colored dots; foliage faintly smells of gardenia. **Floral:** flowers unisexual (but borne on different trees), clustered in the axis of leaves. **Fruit:** achenes enclosed in a fleshy, red, berry-like structure (accrescent sepals).

**Distribution:**

**Historical:** Hawaii. **Current:** Only three extant populations are known, all are on Hawaii.

**Habitat:**

**Substrate:** Most plants are found on Mauna Loa aa flows approximately 4,000 years old. A single individual was found in a crack on a rocky tumulus located in a 6,000-year old

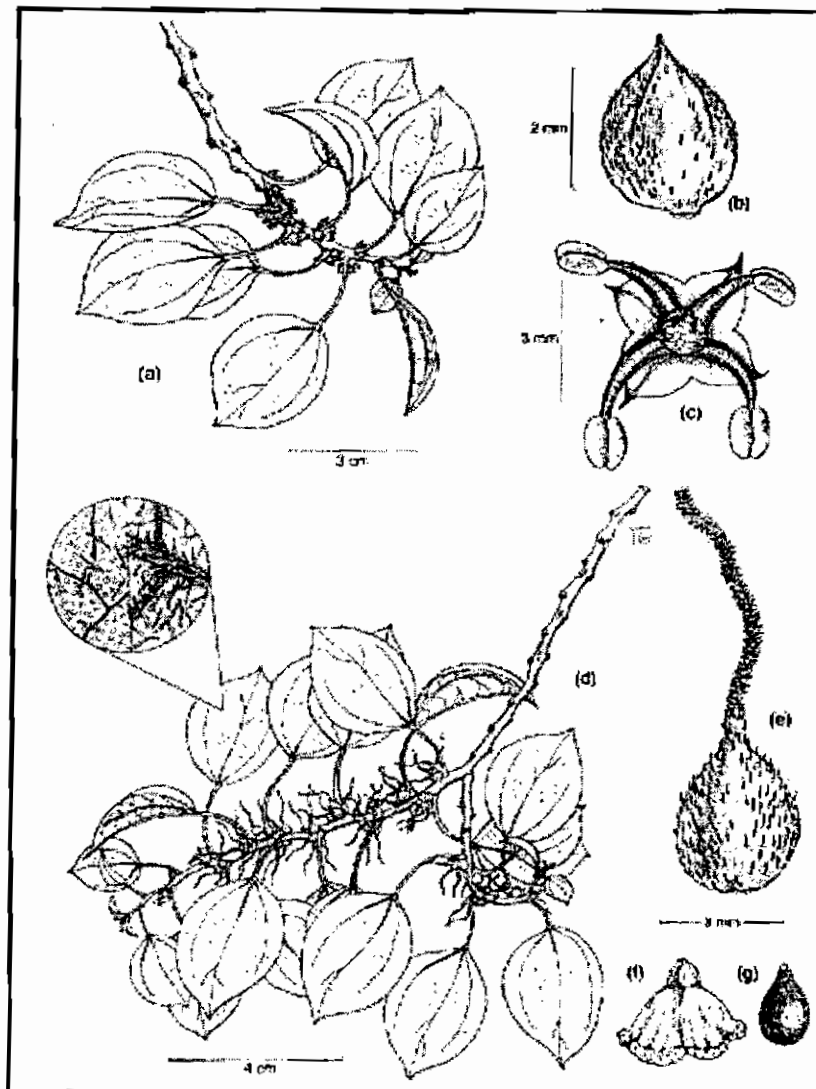
Mauna Loa pahoe flow. **Plant Communities:** Open *Metrosideros* Treeland with sparse shrub understory and *Myoporum* Shrubland.

**Estimated Number of Individuals on PTA:** Approximately 12 individuals have been found on the installation.

**Threats:** The small number of individuals and browsing by feral sheep and/or goats present the greatest threat to the species. Feral ungulates have created an obvious browse-line on the adult plants.

**Comments:** On PTA, *Neraudia ovata* typically is found growing in clumps of *Myrsine lanaiensis*, which makes the former species difficult to detect. The lenticular bark closely resembles the bark of *Zanthoxylum hawaiiense*.

**Figure 38.** *Neraudia ovata*: (a) branch with staminate flowers in axillary clusters; (b) closed staminate flower; (c) open staminate flower; (d) branch with pistillate flowers in axillary clusters (insert shows magnified leaf surfaces with cystoliths on the upper side and pubescence on the underside); (e) pistillate flower covered with erect hairs and exserted stigma; (f) achenes; and (g) seed.

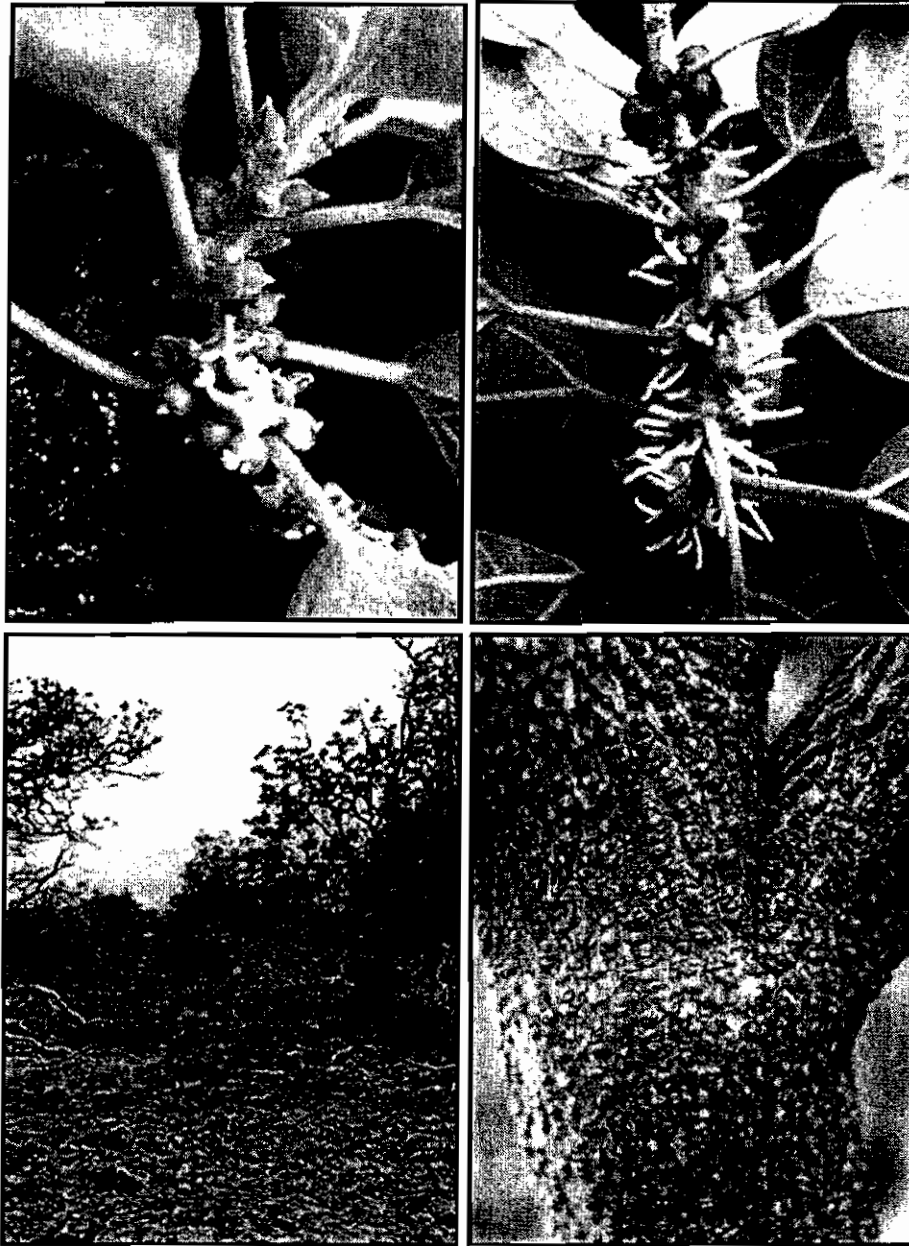


**Figure 39.** *Neraudia ovata*: (a) branch showing staminate flowers in leaf axis (note whitish dots on top



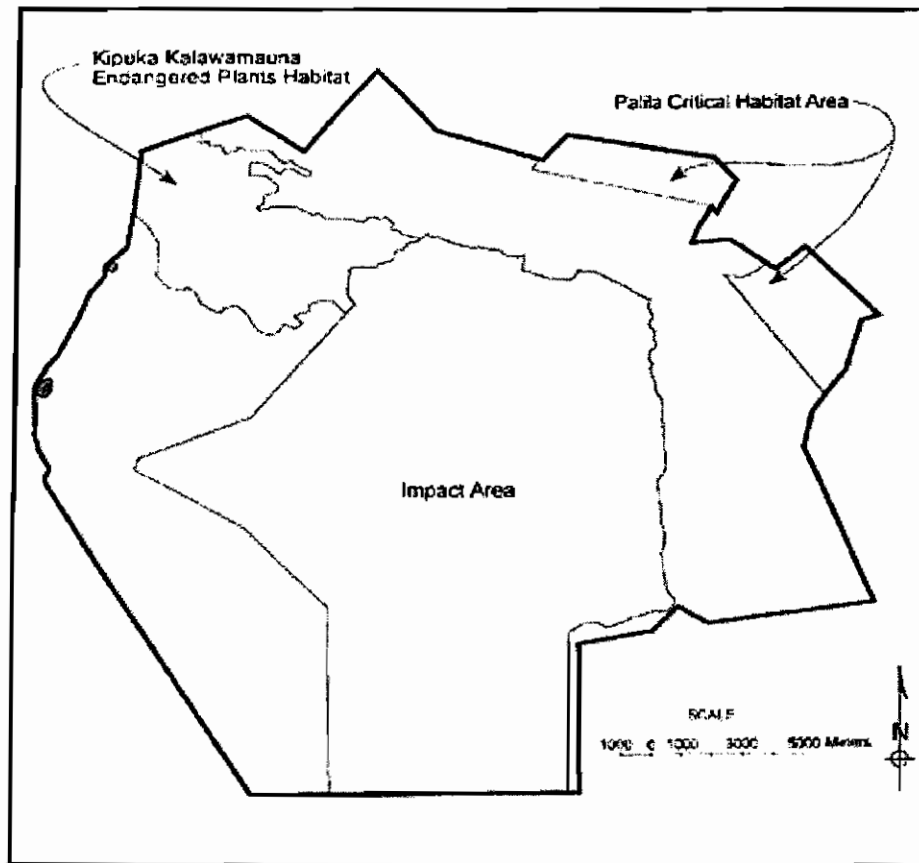
leaf surface); (b) branch showing pistillate flowers and reddish fruits in leaf axis (note distinct three-nerved pattern on underside of leaf); (c) lenticular bark; and (d) typical habitat in Open *Metrosideros* Treeland with sparse shrub understory.

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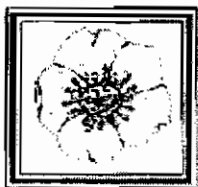


**Figure 40.** Distribution of *Neraudia ovata* on Pohakuloa Training Area, Hawaii.





***Portulaca sclerocarpa* A. Gray**



**Family:** Portulacaceae (Purslane Family)

**Common Name:** Hard Fruit Purslane, Poe, Ihi, Ihi Makole

**Federal Status:** Endangered

**Description:**

**Life Span:** perennial. **Habit:** a prostrate herb growing from a fleshy or woody taproot. **Vegetative:** stems trailing or only slightly erect; leaves pale green, linear, nearly round in cross-section, fleshy or succulent. **Floral:** flowers 2-6 in small heads at the tips of branches and subtended by numerous long white hairs; petals white or pink. **Fruit:** a thick-walled capsule with numerous small, glossy seeds.

**Distribution:**

**Historical:** Hawaii and Lanai. **Current:** Known from Hawaii Volcanoes National Park and PTA. On the installation, small populations or single individuals have been found in the Kipuka Kalawamauna Endangered Plants Habitat, north and west of Kipuka Alala, and on the 1859 lava flow.

**Habitat:**

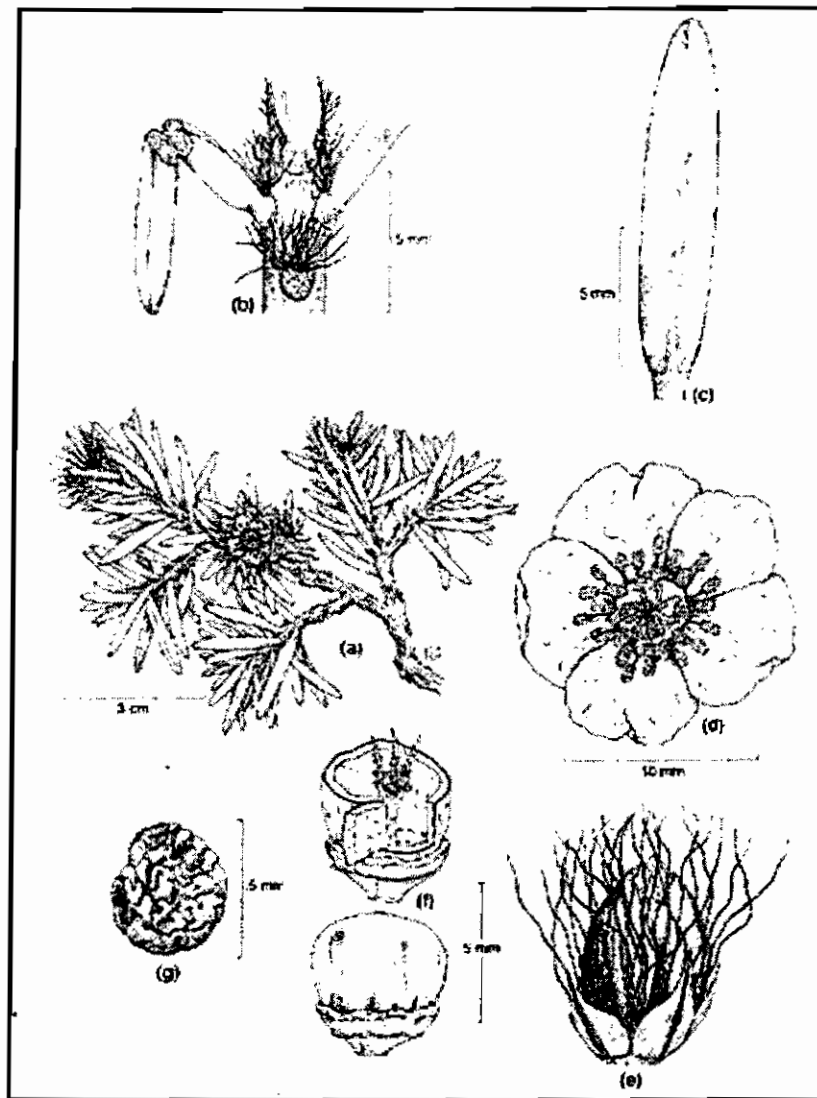
**Substrate:** The species occurs on a wide range of substrates. Within the Kipuka Kalawamauna, *Portulaca sclerocarpa* grows on Mauna Kea flows > 10,000 years old; on the southwestern part of the installation it is found on 3,000-4,000-year old pahoe-hoe lava flows; it is also found on a portion of the 1859 aa lava flow. **Plant Communities:** Barren Lava, Sparse *Metrosideros* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub under-story, Intermediate *Metrosideros* Mixed Treeland, and *Myoporum* Shrubland.

**Estimated Number of Individuals on PTA:** < 30

**Threats:** The small number of individuals is the major threat to the species on the installation. Feral animals might consume the plant during extremely dry periods; however, we have never observed the species being browsed. Fountain grass (*Pennisetum setaceum*) may be invading habitats preferred by *P. sclerocarpa*.

**Comments:** More individuals of this species undoubtedly occur on the installation, but it is extremely difficult to locate the species in the field because of its prostrate growth habit and small size. The flowers are showy but are rarely found open. The plant can be grown from seed under greenhouse conditions.

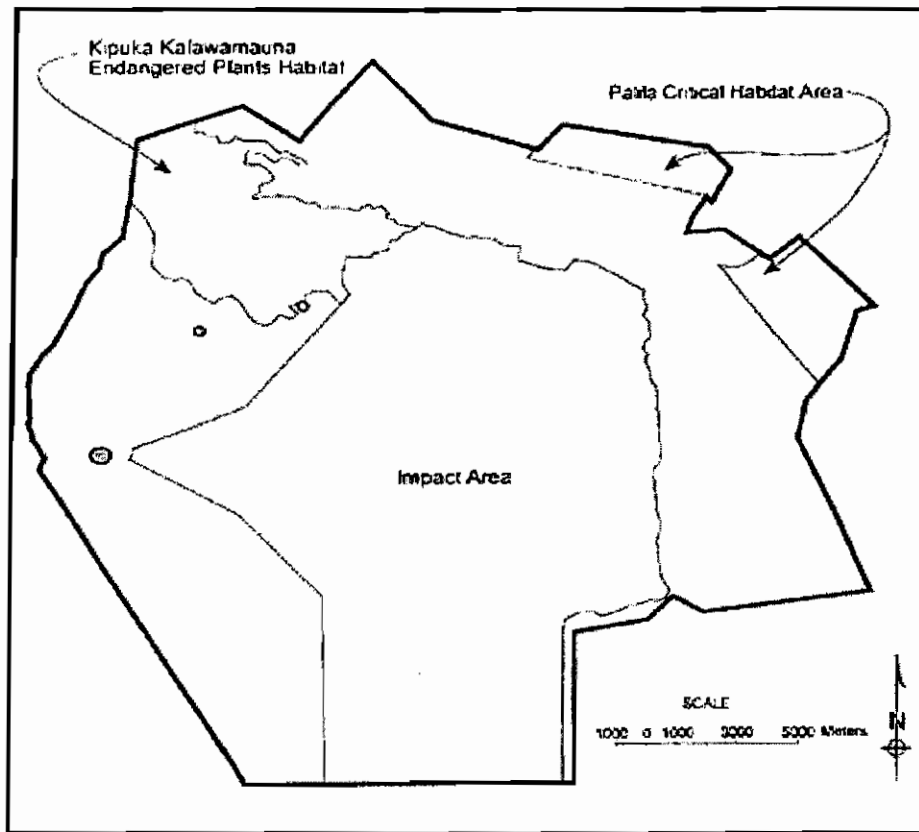
**Figure 41. *Portulaca sclerocarpa*:** (a) general habit; (b) stems showing opposite leaves with tuft of hairs above point of attachment; (c) simple leaf with prominent midrib; (d) top view of flower; (e) side view of immature flower subtended by five scalelike bracts, dense tuft of hairs, and sepals; (f) side view of capsule; and (g) side view of seed.



**Figure 42.** *Portulaca sclerocarpa*: (a) plant growing on barren pahoe-hoe lava; (b) close-up of flower; (c) typical habitat in Open *Metrosideros* Treeland with sparse shrub understory; and (d) field personnel photographing species on pahoe-hoe tumulus. Below clockwise from upper left:



**Figure 43.** Distribution of *Portulaca sclerocarpa* on Pohakuloa Training Area, Hawaii.



***Portulaca villosa* Cham.**



**Family:** Portulacaceae (Purslane Family)

**Common Name:** Hairy Purslane, Ihi

**Federal Status:** None

**Distribution:**

**Life Span:** perennial. **Habit:** an herb arising from a fleshy or woody taproot. **Vegetative:** stems trailing to slightly erect; leaves pale green, linear, nearly round in cross-section, fleshy or slightly succulent, and without a petiole. **Floral:** 3-6 flowers in heads at the tip of the branches, subtended by dense hairs and a series of reduced leaves; petals white or pink, notched at the tip. **Fruit:** a thin-walled capsule with numerous small reddish-brown seeds.

**Distribution:**

**Historical:** All the main islands except Niihau and Kauai. **Current:** Believed to still exist on Hawaii, Maui, Lanai, Molokai, Kahoolawe, and Oahu. At PTA, populations found on south- and southwestern-facing slopes of Puu Keekee.

**Habitat:**



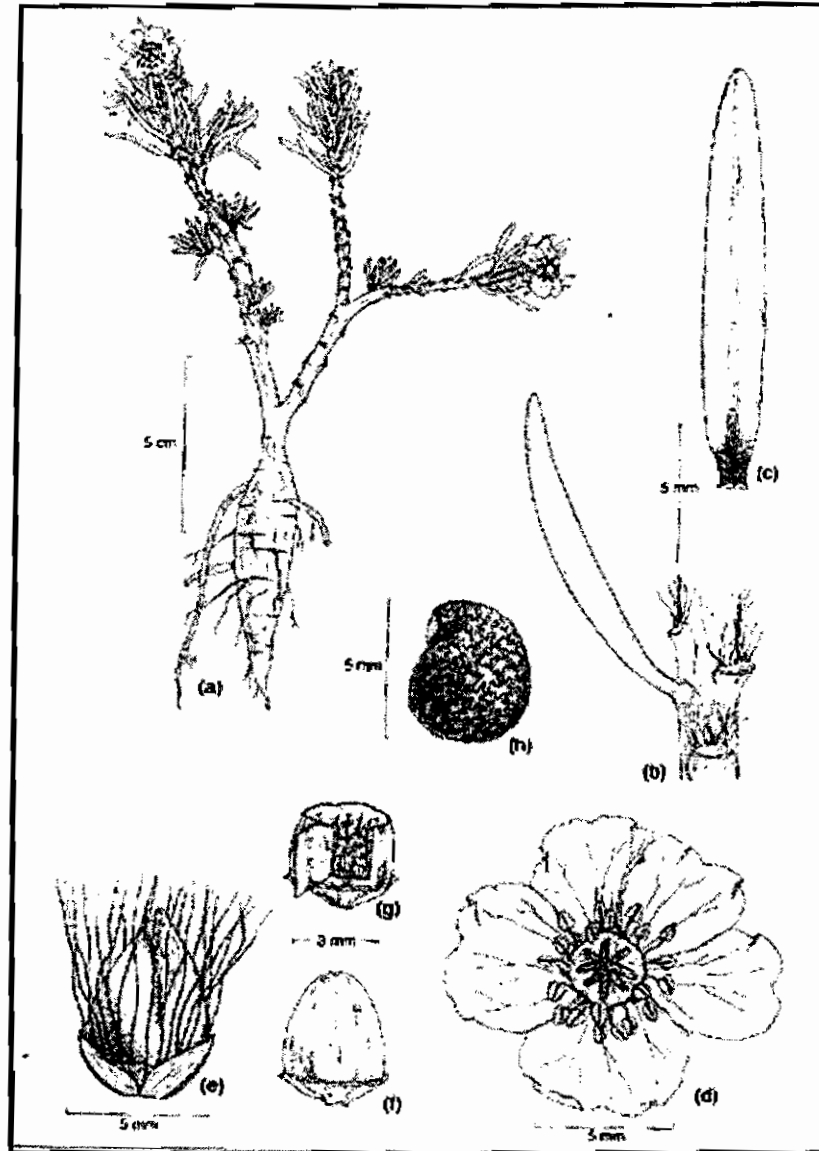
**Substrate:** On the installation, the plant occurs on Mauna Kea rocky outcrops on the upper slopes of an old, heavily eroded, cinder cone. It grows at approximately 1,750 m at PTA.  
**Plant Communities:** Open *Dodonaea* Shrubland and *Dodonaea* Mixed Shrubland.

**Estimated Number of Individuals on PTA:** < 150

**Threats:** The greatest threat to *Portulaca villosa* is wildfire caused by humans. Historically, Puu Keekee has accidentally burned as a result of military training activities. As with *P. sclerocarpa*, feral animals might consume *P. villosa* during periods of drought; though evidence of such damage has not been observed.

**Comments:** The PTA population is growing at the highest elevation reported for the species. Typically it is a coastal or low-elevation plant. Plants have been found along tank trails on private lands above Kawaihae. Perhaps military vehicles using the trails have transported the species to the installation. On Puu Keekee, *P. villosa* occurs in an area typically inhabited by the threatened species, *Silene hawaiiensis*.

**Figure 44.** *Portulaca villosa*: (a) general habit, showing large fleshy tap root; (b) section of stem showing sessile leaf and small tuft of hairs above point of attachment; (c) simple, linear leaf with prominent midrib; (d) top view of open flower; (e) side view of immature flower showing subtending bracts, hairs, and sepals; (f) side view of capsule; (g) side view of capsule with section removed to show interior; and (h) side view of seed.



**Figure 45.** *Portulaca villosa*: (a) plant growing on barren cinder; (b) close-up of flower and leaves; (c) typical habitat in Open *Dodonaea* Shrubland on Puu Keekee; and (d) field personnel viewing the species on rocky tumulus.  
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